

CABOT (R. C.)

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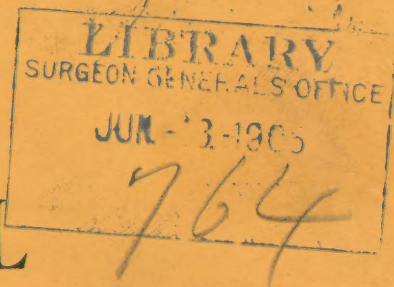
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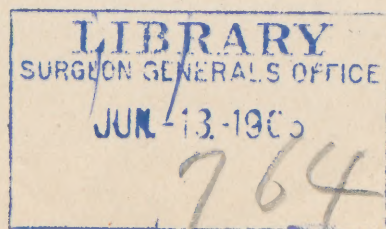
BY RICHARD C. CABOT, M.D.,
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What is the blood? It has often been spoken of as a tissue, but I think we stretch unduly the meaning of the word "tissue" when we try to include under it a circulating fluid full of cells which differ from each other essentially in origin, in function and in morphology.

I.

The comparison between the blood vessels and their contents, on the one hand, and the highways or waterways of a country, is a very familiar one, but I think the full force and fitness of such a comparison was never fully brought home to me until I read in Rudyard Kipling's last and best book, "Kim," the description of the Grand Trunk road and of "Kim's" adventures thereon. You will doubtless recall Kipling's description of this colossal road, striking straight across India, somewhat raised above the surrounding country and constantly receiving traffic through the lanes entering it from the different villages along the way. Along these side tracks, parties of passengers on foot or on horse were constantly being emptied into the main stream or passing out from that main stream to make their way and settle in the different towns.

Now "Kim's" interest in this constantly shifting picture was remarkably like our interest in the blood. He was interested, as we are, in the *sources of supply*, in the birthplace of the different tribes constantly emptying their members into the stream, and we are reminded that this problem of the source and origin of



the different cells which inhabit the blood stream is one of perennial interest in haematology. Again, "Kim" was interested to see how, despite the constant accessions and losses, the total volume of the stream remained, on the whole, impressively constant; and who of us, who has studied the blood, has not wondered to see how, despite the constant destruction and new formation of cells, the total number in a unit of volume varies within remarkably narrow limits?

"Kim" noticed that on the Grand Trunk road there were, besides the ordinary passengers, certain amazing strangers, like the Lama, and others whose presence on the road portended war or famine. Precisely so in the blood we come across, now and then, cells which make us stop and stare, as the people stared at the Lama on the Grand Trunk road. We note the signs of starvation (anaemia) or of infection (war); we meet the war-tribes out to repel an attack, or to pick up the pieces, (leucocytosis).

"Kim" saw, on the road, babies, decrepid old men, the sick and the maimed, and in the blood stream we note all these aberrations from the normal, (young cell, old or degenerate cells).

II.

The beasts of burden, the caravans which fill so much space upon the road, have their parallel in the blood in those beasts of burden, those oxygen carriers, the red corpuscles—the most machine-like inhabitants of the road, driven passively along, without powers of self-direction, blind. Yet upon these beasts of burden the whole organism depends for food and fuel, as the whole of India depends upon its caravans. When, as recently occurred in the Philippines, these beasts of burden died by thousands, poisoned by a parasite, as the red corpuscles are poisoned by the parasite of malaria, the whole state is starved, becomes anaemic, as the body does. Then the half-grown, immature animals have to be pressed into service, just as the half-grown red corpuscles (normoblasts, megaloblasts) come into the blood vessels to do the work of respiration in anaemia.

There are congestions of traffic among the beasts of burden, as there are among the red corpuscles (cyanosis), and these are painful but usually temporary.

III.

Besides the more numerous and passive oxygen-carriers, which are driven along the road in steady stream that varies but

little, we have those more active and intelligent beings, the leucocytes, which certainly are higher up in the scale of life. Like the different tribes which "Kim" saw constantly pouring into the main road from far distant provinces, each tribe with its peculiar dress and manner, or again leaving the main road in groups to reach and settle in this or that village—or to join a war party—so the different tribes of leucocytes, equally various in look and movement enter and leave the blood vessels from time to time.

One tribe (the polynuclears) lives chiefly on the road—a sort of drummer-tribe; another (the lymphocytes) is chiefly a stay-at-home tribe, much more fixed and inert in their habits; while others (the eosinophiles and the mast cells) are constantly present in very small numbers—comparative varieties in the blood highway—though far more numerous in the fixed tissues.

Finally, there are certain amazing strangers (the myelocytes and other rare forms) at whom every one stares as at Kipling's Lama, and a few immature striplings, like "Kim" himself, who have no right to be there *so young*.

Myelogenous leucaemia, from this point of view, appears as a form of universal insanity which leads all the members of these tribes—men, women and children, in all stages of immaturity and decrepitude—to *take to the road* and aimlessly wander there until they bring themselves and the whole country to starvation and death. Yet while it lasts, this crazy procession is a wonderful sight, as those who have seen the blood of myelogenous leucaemia can testify. Endless variety is what meets our eye. No two members of the crowd are alike. Classification is impossible, except in the roughest way.

Lymphatic leucaemia presents the sharpest possible contrast. Here it is as if one single tribe had multiplied so fast that, spreading throughout the country by means of the highways, it gradually replaces and crowds out all other tribes, producing a terrible monotony of type everywhere. Such is the picture of lymphatic leucaemia. One variety of cells—the lymphocyte—is enormously increased and, being distributed by the blood stream to all the tissues, takes root, grows, and crowds out all other cells, not only in the blood vessels, but in the fixed tissues.

Still keeping to our simile, we may represent *leucocytosis* by the restless activity of one war-like tribe, the polynuclear cells, which are constantly passing in and out of those highways which we call blood-vessels, occasionally taking their young along

with them (a few myelocytes in leucocytosis), but always making for the seat of war—that is, of infection. Yet there are certain invaders, for example typhoid bacilli or malarial parasites, against whom the leucocytes can never be induced to bestir themselves, and if the numbers of the enemy are overwhelming, no matter to what tribe they belong, the polynuclear leucocytes stay at home (lack of leucocytosis in severest infections).

But it is not only for war that the leucocytes assemble in the vessels. Any serious disturbance of the State (toxaemia), any unusual activity (severe muscular exertion), brings them in increased numbers into the highways.

We see, then, how the blood is representative of the whole organism, just as the traffic upon the Grand Trunk road is representative of all India, representative as no single state or town (no single bodily organ) can be. Examine a specimen of the traffic on any of the highways and we get, directly or indirectly, a great fund of information. We find what class is numerous or scanty, whether immature or decrepid or diseased forms are on the march, whether the ranks have been thinned by parasites, whether there is war in the land. No wonder the clinician, who is the government's secret service agent, goes to those highways which we call the blood vessels, when he needs to know what is amiss in the organism!

